

FAKULTET TEHNIČKIH NAUKA
GEODEZIJA I GEOINFORMATIKA

INŽENJERSKA GEODEZIJA 3
- VEŽBA 8 -

NOVI SAD, 2024

Proračun tačnosti proboja tunela

- Relativne elipse grešaka

$$\Delta \mathbf{x} = \begin{bmatrix} \Delta \hat{X}_{ij} \\ \Delta \hat{Y}_{ij} \end{bmatrix} = \begin{bmatrix} \hat{X}_j - \hat{X}_i \\ \hat{Y}_j - \hat{Y}_i \end{bmatrix} = \mathbf{G}_{ij} \hat{\mathbf{x}}, \quad \mathbf{G}_{ij} = \begin{bmatrix} 1 & 0 & -1 & 0 \\ 0 & 1 & 0 & -1 \end{bmatrix}$$

$$\mathbf{Q}_{\Delta \mathbf{x}} = \mathbf{G}_{ij} \mathbf{Q}_{\hat{\mathbf{x}}} \mathbf{G}_{ij}^T, \quad \mathbf{K}_{\Delta \mathbf{x}} = \hat{\sigma}_0^2 \mathbf{Q}_{\Delta \mathbf{x}}, \quad \mathbf{Q}_{\Delta \mathbf{x}} = \begin{bmatrix} Q_{\Delta X \Delta X} & Q_{\Delta X \Delta Y} \\ Q_{\Delta Y \Delta X} & Q_{\Delta Y \Delta Y} \end{bmatrix}$$

$$A_R = \sigma_0 \sqrt{\frac{1}{2} (Q_{\Delta X \Delta X} + Q_{\Delta Y \Delta Y} + k) \cdot \chi_{1-\alpha, f}^2}$$

$$B_R = \sigma_0 \sqrt{\frac{1}{2} (Q_{\Delta X \Delta X} + Q_{\Delta Y \Delta Y} - k) \cdot \chi_{1-\alpha, f}^2}$$

$$k = \sqrt{(Q_{\Delta X \Delta X} - Q_{\Delta Y \Delta Y})^2 + 4Q_{\Delta X \Delta Y}^2}$$

$\chi_{1-\alpha, f}^2$ - kvantil χ^2 raspodele za nivo značajnosti α i broj stepeni slobode f .

$\chi_{0.95, 2}^2 = 5.99$, za $\alpha = 0.05$ i $f = 2$.

Excel: $\chi_{1-\alpha, f}^2 \rightarrow \text{CHIINV}(\alpha, f)$

Proračun tačnosti proboja tunela

- Relativne elipse grešaka

$$\theta_R = \frac{1}{2} \left(\arctan \left(\frac{2Q_{\Delta X \Delta Y}}{Q_{\Delta X \Delta X} - Q_{\Delta Y \Delta Y}} \right) + KV \right)$$

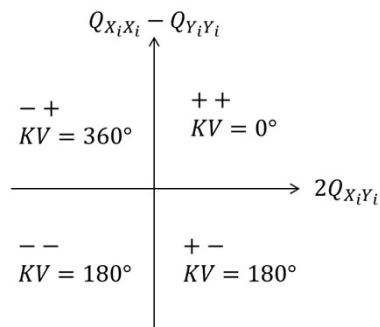
Primer:

$$2Q_{\Delta X \Delta Y} = -2$$

$$Q_{\Delta X \Delta X} - Q_{\Delta Y \Delta Y} = -2$$

$$KV = 180^\circ$$

$$\theta = \frac{1}{2} \left(\arctan \left(\frac{-2}{-2} \right) + KV \right) = \frac{1}{2} (45^\circ + 180^\circ)$$



Proračun tačnosti proboja tunela

- Transverzalna i longitudinalna tačnost proboja tunela

$$\sigma_Q^2 = A_R^2 \sin(t - \theta_R)^2 + B_R^2 \cos(t - \theta_R)^2$$

$$\sigma_L^2 = A_R^2 \cos(t - \theta_R)^2 + B_R^2 \sin(t - \theta_R)^2$$

t – orijentisani pravac tunelske cevi

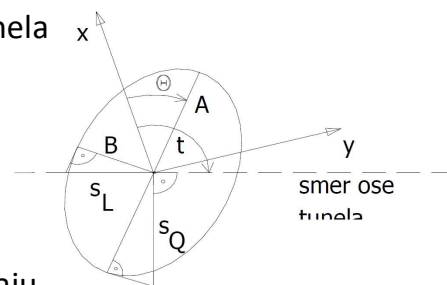
A_R, B_R i θ_R – parametri relativne elipse grešaka

- Dozvoljena odstupanja u postupku proboja računaju se na sledeći način:

$$\Delta Q = \pm 60\sqrt{L} \text{ mm}$$

$$\Delta L = \pm 23\sqrt{L} \text{ mm}$$

L – dužina tunelske cevi u kilometrima



Grafička interpretacija

- AutoCAD

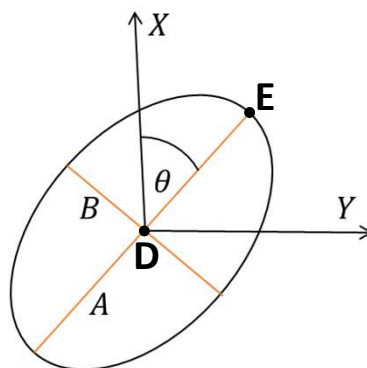
ELLIPSE

C – Centar elipse

Y_D, X_D – Koordinate tačke D

Y_E, X_E – Koordinate tačke E

B – Mala poluosa elipse



```

5 ELLIPSE
6 C
7 1254.3438,1814.407
8 1264.63486860732,1813.8676466571
9 7.782867822
  
```